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Nursing judgement and decision-making using the Sedation Withdrawal Score (SWS) in children

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Dear Editors,

RE: JAN-2016-0498.R1

Thank you for the comments you provided about our revised paper, the responses to which are detailed below.

Minor comments

All minor comments have been amended as suggested, itemised as follows:

P3 changed to “approaches”

P4 changed to “in the development of scoring tools to support clinical practice” as suggested.

P6 changed to “patient”

P9 brackets removed

P11 First sentence has been reworded.

P12 changed to “nurses in our hospital.”

Concern about the content of the vignettes

A 400-word section of text has been revised (pages 9-10) to supply a more detailed explanation for the use of the apparently 'stripped down' vignette. We agree it does perhaps feel counter-intuitive to provide such a minimal vignette but this decision is methodologically sound. Developmental vignettes aim to mimic stages of information processing in clinical practice, reflecting how contextual information “grows” when it is considered, sought out or reflected upon. V1 mimics the point at which an assessment has been completed, but before the patient-specific context has been considered. As you point out, contextual information is readily available to the nurse in clinical practice; what is not known is whether they make use of this information to understand the meaning of behavioural signs. This is important because the developers of withdrawal assessment tools assume nurses do consider the patient context. This study design provides the opportunity to study whether nurses are willing to make a diagnosis without reflecting on important contextual data; which if they are willing, will evidently be flawed.

We trust the revisions we have made have addressed your concerns.

Yours sincerely,

Impact statement

Making the right decisions in complex clinical situations is not simple and the Sedation Withdrawal Score tool did not support the depth of thinking necessary to successfully negotiate the confounding factors. Users of tools can be supported to improve their critical thinking; incorporating metacognition into education programmes is one approach. Multiple scoring tools are used in healthcare, yet the way these are actually used is rarely studied. If tools are to achieve their intended outcomes then more research should be undertaken to explore the way they are used.

NURSING JUDGEMENT AND DECISION-MAKING USING THE SEDATION WITHDRAWAL SCORE (SWS) IN CHILDREN

ABSTRACT

Aims

The aim of the study was to evaluate registered children's nurses' approaches to the assessment and management of withdrawal syndrome in children.

Background

Assessment of withdrawal syndrome is undertaken following critical illness when the child's condition may be unstable with competing differential diagnoses. Assessment tools aim to standardise and improve recognition of withdrawal syndrome. Making the right decisions in complex clinical situations requires a degree of mental effort and it is not known how nurses make decisions when undertaking withdrawal assessments.

Design

Cognitive interviews with clinical vignettes.

Methods

Interviews were undertaken with 12 nurses to explore the cognitive processes they utilised when assessing children using the Sedation Withdrawal Score (SWS) tool. Interviews took place in Autumn 2013.

Findings

Each stage of decision-making – noticing, interpreting and responding – presented cognitive challenges for nurses. When defining withdrawal behaviours nurses tended to blur the boundaries between SWS signs. Challenges in interpreting behaviours arose from not knowing if the patient's behaviour was a result of withdrawal or other co-morbidities.

Nurses gave a range of diagnoses when interpreting the vignettes, despite being provided with identical information. Treatment responses corresponded to definite withdrawal diagnoses, but varied when nurses were unsure of the diagnosis.

Conclusion

Cognitive interviews with vignettes provided insight into nurses' judgement and decision-making. The SWS does not standardise the assessment of withdrawal due to the complexity of the context within which assessments take place and the difficulties of determining the cause of equivocal behaviours in children recovering from critical illness.

SUMMARY STATEMENT

Why is this research or review needed?

There is little research that considers how children's nurses make decisions in complex clinical situations with regards to assessment of withdrawal syndrome.

Assessment of withdrawal syndrome is challenging due to competing differential diagnoses and inaccurate assessment may lead to unnecessary changes to a child's treatment.

What are the key findings?

Making the right decisions in complex clinical situations is not simple and the Sedation Withdrawal Score tool did not support the depth of thinking necessary to successfully negotiate the confounding factors.

Once a validated tool is adopted into clinical practice the challenge is that individual practitioners think differently and at different levels to each other and this is rarely accounted for in the development of scoring tools to support clinical decisions.

Not every practitioner will approach the complexity of the task with the same level of critical thinking.

How should the findings be used to influence policy/practice/research/education?

Complex clinical situations cannot be made simpler but users of tools can be supported to improve their critical thinking; incorporating metacognition into education is one approach.

Multiple scoring tools are used in healthcare, yet the way these are actually used is rarely studied. If tools are to achieve their intended outcomes then more research should be undertaken to explore the way they are used.

KEY WORDS

Cognitive interviewing, critical care, paediatric, nursing assessment, cognitive errors

INTRODUCTION

Children admitted to the paediatric intensive care unit (PICU) require adequate sedation and analgesia for the duration of their critical illness (Jenkins 2002). Many of these drugs cause physical dependence, which means that once the child is recovering the drugs should to be tapered, rather than being stopped abruptly to prevent withdrawal syndrome (Cunliffe *et al*. 2004, Easley & Nichols 2008). Although each drug has a distinctive withdrawal syndrome, many of the signs of withdrawal are the same across drug groups. Individually however, these equivocal signs are ambiguous in the critically ill child, possibly indicating pain, delirium, the underlying condition, deterioration or withdrawal (Harris *et al.* 2016)

BACKGROUND

The assessment of withdrawal syndrome in children is complex. Structured and repeatable assessments are recommended to assist detection, but it is often unclear how these are applied by nurses. Three published tools have been developed to monitor withdrawal in children; the Sedation Withdrawal Score (SWS) (Cunliffe *et al.* 2004), the Withdrawal Assessment Tool (WAT-1) (Franck *et al.* 2008) and the Sophia Observation Score (SOS) (Ista *et al.* 2009). Each is a checklist of non-specific signs that, in combination, appear to support a diagnosis of withdrawal (Table 1). The SWS is the withdrawal assessment tool and treatment protocol used in our hospital since 2004. SWS has proven clinically useful in identifying withdrawal signs in ICU and ward-based patients, but has not been validated (Macqueen & Bruce 2012). Both WAT-1 (Franck *et al.* 2008, 2012) and SOS (Ista *et al.* 2009, 2013) have been validated but the studies excluded patients whose existing behaviour might confound the withdrawal assessment and clinical utility is further limited by the lack of linked treatment protocols.

The assessment is complex due to the multiple drug and patient factors to be considered. Drug factors include the likelihood of physical dependence, which varies depending on drug dose and duration of therapy (Amigoni *et al.* 2014, da Silva *et al.* 2016) but also appears highly individualised (Best *et al*. 2016) and may be further complicated by concurrent tapering of more than one sedative or analgesic drug. Patient factors include the highly individualised effects of withdrawal on the child's recovery (Franck *et al.* 2008) and the confounding effect of the patient's primary medical condition on withdrawal intensity (Franck *et al.* 2008). Assumptions are made that the nurse will modify the assessment to ensure the underlying condition or any external factors do not skew the withdrawal score

(Franck & Vilardi 1995, Ista *et al*. 2013, Harris *et al.* 2016). Complex tasks like this demand a degree of cognitive effort and focussed attention on the part of the nurse, to make correct judgments and decisions. Given that the judgement of the bedside nurse has been a 'silver standard' in tool validation studies (Franck *et al.* 2008, Ista *et al.* 2009), it is important to understand how nurses think when undertaking withdrawal assessments and making treatment choices (Easley & Nichols 2008).

Two key theoretical approaches to clinical decision-making are reasoning and intuition (Banning 2008). Different academic disciplines have investigated the analytical, rational approach of reasoning and similar models have emerged to describe the key stages of the process (Table 2). Remaining open minded throughout these stages is vital, as relevant cues can be subtle and may be overlooked, particularly if the situation is changing quickly or there is too much to take in simultaneously (Gaba *et al.* 1995). Knowing how to filter tenuous cues and focus on relevant ones is a feature of expert nursing practice (Harbison 2006).

Intuition is defined as "a way of knowing something immediately as a whole that improves with experience" (Rew & Barrow 2007, p. E25). This enables the clinical expert to process and identify key diagnostic components subconsciously (Lyneham *et al.* 2008). In high-pressure circumstances, the rational approach is somewhat idealistic as clinical decisions are often required despite incomplete knowledge of the situation (Graber *et al.* 2002). Under these conditions, experienced clinicians rely on intuition to "think fast" (Kahneman 2011, p. 13), using pattern recognition(Berner & Graber 2008, Gobet & Chassy 2008) and heuristics (Elstein 1999, Cranley *et al*. 2009). However, intuitive processing can be flawed (Graber *et*

al. 2005), especially in an unpredictable environment (Kahneman & Klein 2009) such as critical care.

No published papers were identified that considered how nurses make decisions about the assessment and management of withdrawal in children. This study sought to fill this knowledge deficit by attending to the three stages of decision making; noticing, interpreting and response.

AIM

The aim of the study was to explore registered children's nurses' decision-making during the assessment and management of withdrawal in children by examining:

1. Noticing: the nurses' recognition and understanding of four clinical signs from the SWS tool.
2. Interpreting: the meaning of an SWS score, in terms of a diagnosis of withdrawal, presented in two clinical vignettes;
3. Response: the treatment choices made in response to the withdrawal diagnosis

DESIGN

Cognitive interviews were undertaken using clinical vignettes to explore the study aims. Cognitive interviews are a recognised approach to explore cognitive processing in relation to decision-making (Willis 2005, Ross *et al.* 2012). The fundamental features of cognitive interviews are think aloud and verbal probing: techniques which permit the researcher to listen in to the complex and usually hidden evolution of (clinical) reasoning without

interfering with the cognitive processes being uncovered (Fonteyn *et al.* 1993). Verbal probing delivered in a neutral manner enables the interviewer to drill down on the issues under investigation, so clinical expertise in the subject area is necessary to recognise when a response needs further probing (Sofaer 2002). All other interaction between researcher and participant is minimised to reduce biasing the participants' responses (Sofaer 2002).

The cognitive interview approach has been employed in other studies investigating nurse decision-making (Cioffi 1998, Simmons *et al*. 2003, Twycross & Powls 2006, Hoffman *et al*. 2009); these are now presented in brief. Cioffi (1998) investigated the effects of experience and uncertainty on triage assessments made by emergency nurses and Simmons et al. (2003) described cognitive processes used by experienced nurses during their patient assessments in elderly care. Work by Twycross & Powls (2006) explored how children's nurses made clinical decisions and Hoffman and colleagues (2009) compared clinical cues collected by novice and expert nurses in intensive care. The cognitive interview approach has also been applied to the psychometric testing of self-report clinical assessment tools, to check that terminology is understood and interpreted consistently by patients (Sofaer 2002, DiBenedetti et al. 2013), so was well suited to the aims of this study.

An experimental setting, using vignettes, was chosen over a naturalistic setting in order to control the clinical data provided to participants and allow comparison between them (Willis 2005, Berner & Graber 2008). By standardising the data, the only variable lay in the nurses' decision making processes (Cook & Rumrill 2005), enabling focus on the abstruse stages of 'noticing' and 'interpreting' rather than simply the outcome or response (Veloski *et al*. 2005). Clinical vignettes were developed by XX (an experienced pain/sedation nurse specialist) to illustrate a typical, complex clinical situation featuring a patient with severe neurological disability (Figure 1). The vignettes were based on a real case from clinical

practice to enhance believability (Endacott *et al.* 2010). Face and content validity were assessed by four senior clinical nurses (members of the Pain and Sedation Service and an Advanced Nurse Practitioner in critical care) experienced in withdrawal assessment (Brattebo 2009).

Typical levels of cognitive stimulation were prompted by using developmental vignettes (Barrows & Feltovich 1987, Veloski *et al*. 2005*),* to measure participants' usual or 'everyday' practice (Peabody *et al.* 2004). The first vignette (V1) supplied minimal information, to reflect initial interpretation at the moment when the SWS score is completed. A diagnosis at this stage would indicate the inclination to 'make do' and uncover the usually hidden assumptions which are made to fill in knowledge gaps. The second vignette (V2) provided additional clinical details reflecting the range of information required to underpin a more considered, contextual interpretation of the same assessment.

For the purpose of this study, diagnosis of withdrawal syndrome is based on two core features:

1. Physical dependence on a drug therapy administered continuously for 5 or more days, or sooner if administered at high doses (Macqueen & Bruce 2012, Harris *et al.* 2016)
2. Behavioural signs of withdrawal, in response to the drug(s) stopping or reducing that are not better explained by other physical, illness or environmental causes (Macqueen & Bruce 2012, Ista *et al.* 2013, Harris *et al.* 2016).

Provision of incomplete, equivocal information was designed to reflect the "fuzziness of unstructured real life situations" (Benner & Tanner 1987, p.24). V1 provided no data on either of the core features of withdrawal. V2 provided data about the likelihood of physical

dependence, but in the absence of a baseline SWS score or trend, insufficient information to establish the cause of behavioural signs.

Sample/ participants

The study was undertaken at a specialist children's hospital in England. The study participants were registered children's nurses, who undertook withdrawal assessments regularly. Purposive sampling was employed to recruit nurses from the clinical areas where withdrawal patients were usually nursed (the Paediatric Intensive Care Unit (PICU), the High Dependency Unit (HDU) and the cardiac ward). Nurses were eligible for inclusion if they undertook withdrawal assessments regularly and considered themselves familiar with the SWS tool. Nurses were recruited by poster or by word of mouth by the researcher during clinical rounds and gave written consent to participate. Interviews took place in Autumn 2013 in quiet rooms adjacent to the clinical areas.

Data collection

Demographic data included gender and experience, in years, of applying the SWS tool in practice. No further demographic data were collected, as the relationship between factors such as years since qualification, level of expertise and level of educational attainment, on decision-making is unclear (Lauri & Salanterä 1998, Hoffman *et al*. 2004, Fick *et al.* 2007). Consideration was given to the sequence of the interview to minimise the potential impact on typical thought processes by unintentionally problematising aspects of nursing care that may be relatively routine (Jenkins *et al.* 2010). The first part of the interview: interpreting SWS scores and responding with treatment choices, aimed to replicate routine clinical practice using the SWS tool and reflect the largely subconscious and automatic synthesis of information nurses undertake. V1 was presented followed by V2. After reading each

vignette, participants were asked to 'think aloud' whilst responding to the pre-set questions and scripted probes e.g., "Is this patient withdrawing?" and "How easy or difficult is it to decide whether the patient is withdrawing?" A list of treatment options for the patient in V2 was then presented and nurses were reminded to 'think aloud' whilst they made a decision. Options included all drugs mentioned in V2 in addition to 'no intervention' and 'another intervention'.

The second part: noticing (defining and interpreting) individual withdrawal signs was anticipated to be more cognitively taxing, possibly causing nurses to critically reflect on their current approach to, and alter subsequent, withdrawal assessments. Consequently, nurses were asked not to discuss their interview experience with colleagues until the study was completed. In order to encourage deeper reflection on issues raised by the vignette, nurses were asked to define four pre-selected SWS terms ('insomnia', 'irritability', 'respiratory distress', 'hypertonicity') that preliminary work had identified as being differently understood by nurses at our hospital. The nurses were also asked how easy or difficult it is to decide when a patient displayed one of these four behaviours.

Ethical considerations

Ethical approval for the study was obtained from an NHS Research Ethics Committee.

Data analysis

Interviews were conducted by XX (who had training in cognitive interviews and clinical expertise in the recognition and management of withdrawal syndrome) and were audio-recorded and transcribed by a professional transcriber. 'Informal analysis', the approach proposed by (Willis 2005, p. 156) was used to identify cognitive problems with decision-making. Subjective interpretation is key to informal analysis, which rather than a formal

coding scheme, also relies on expert judgement to identify problems (Fonteyn *et al*. 1993). Analysis involved two stages; firstly the identification of the decision-making processes including cognitive errors made when noticing, interpreting and responding within individual interviews and secondly, comparison across interviews to elucidate trends. The term cognitive error is used to describe any flawed judgement or inaccurate decision made by the participants.

Validity and reliability

Validity and reliability were considered carefully in design and implementation of the study. A challenge in studying usual behaviour is how to do this without observation bias or research participant effects (McCambridge *et al*. 2014). In decision-making studies, the ideal research method has minimal impact on typical, subconscious reasoning and does not lead to an altered, more conscious level of reasoning. Research participant effects - the change in behaviour as a consequence of being studied (McCarney *et al*. 2007)- have been demonstrated in observational studies investigating antibiotic prescribing behaviour in paediatricians (Mangione-Smith *et al*. 2002) and compliance with hand hygiene in clinical settings (Eckmanns *et al.* 2006, Maury *et al.* 2006). In these studies, participants were more likely to demonstrate or take a best practice approach. In studies investigating decision-making, the manner of questioning may also stimulate new thinking (McCambridge *et al*. 2014) or change the effort paid to the cognitive task (Sitterding *et al.* 2012). These effects may limit the generalisability of clinical research to routine practice (McCarney *et al.* 2007). The cognitive interview technique is inherently suited to this study as it is not considered to alter the effort or attention paid to the task and is also widely used in psychometric testing of survey instruments (Sofaer 2002).

The vignettes were based on a real case and therefore reflected real practice and these and the verbal probes were pilot tested prior to use in the study. Their sensitivity and specificity was evident in that they generated data that identified both cognitive errors and correct decisions. The rigour of interpretive thinking and analysis was supported through dialogue and challenge by the supervisory team.

FINDINGS

Twelve registered children's nurses participated in the interviews; four from the PICU, four from the Cardiac Ward and four from the HDU. All participants were female. The nurses had been undertaking withdrawal assessments for between 4 and 13 years (median 10 years) so were experienced in this aspect of their clinical role. Interviews lasted between 21 and 47 minutes.

In both vignettes, nurses' drew on all three options: 'withdrawing', 'not withdrawing' and 'unsure' (Table 4). In V1, two nurses recognised there was insufficient information upon which to make any judgement. Responses to 'How easy or difficult was it to decide?' ranged from 'easy' to 'very difficult' with one nurse commenting that it "should be easy with more information". All nurses who found the diagnosis 'easy' made a definite diagnosis.

In V2, the responses to 'How easy or difficult was it to decide?' ranged from 'quite easy' to 'very difficult'. Some nurses found V2 "easier than previous [vignette]" and one thought it was "harder with more information". Again, those finding the diagnosis 'easy' all made a definite diagnosis. Those who found it "easier than previous" each gave a different diagnosis. The nurse finding V2 "harder with more information" was 'unsure' in both vignettes. In terms of consistency of opinion across the vignettes, three people who made a

diagnosis in V1, persisted with their diagnosis in V2 ('yes' n=2, 'no' n=1). Four nurses were 'unsure' in both vignettes. The two nurses who could not comment in V1 were 'unsure' in V2 and found the decision 'difficult'.

Diagnosis of withdrawal was commonly based on the SWS score in V1, although the child's underlying condition was recognised as a possible cause for the score (Table 4). In V2, more nurses recognised that the SWS score might reflect either the child's underlying conditions or their normal behaviour. Some nurses recognised that the duration of sedation described was too short to cause physical dependence and hence withdrawal symptoms. The three nurses who diagnosed 'not withdrawing' made this observation along with one nurse who still diagnosed the patient as 'withdrawing'. Four nurses made explicit assumptions during their deliberations in V1. Three of these nurses diagnosed withdrawal; one was 'unsure'. Two nurses made assumptions in V2. One nurse made assumptions in both vignettes, and diagnosed 'withdrawal' in both cases. The second nurse was 'unsure' in both vignettes, but found V2 "easier than previous". The common assumption in V1 was based on the length of ICU stay and related to possible sedatives the child might have received and the possibility of mechanical ventilation.

Treatment response

Treatment choices corresponded to the diagnosis when the diagnosis was definite but varied amongst nurses who were "unsure" (Table 3 and Figure 2). Nurses who diagnosed 'withdrawing' chose to stop weaning chloral hydrate and 'maybe' increase chloral and give codeine ('yes' n=2, 'maybe' n=1). In contrast, nurses who diagnosed 'not withdrawing' chose to continue weaning chloral hydrate. Two nurses considered giving additional analgesia including codeine, paracetamol and oral morphine. Nurses who were 'unsure'

chose a range of interventions, including stop weaning chloral hydrate, increase chloral, give codeine and no intervention. Paracetamol was chosen as 'another intervention' by five nurses who had varied opinions about whether the child was withdrawing.

Failed heuristics and biases were identified during protocol analysis and these cognitive errors were categorised according to definitions cited by Croskerry (2003) (Table 5). Cognitive errors occurred during the decision-making processes involved in both the interpretation of and response to the SWS score. Every nurse made cognitive errors: the number ranging between 1 and 4 errors per nurse. Not all cognitive errors led to diagnostic errors, as two nurses made assumptions during their deliberations in V1, but these did not translate into an inaccurate diagnosis. No nurse made errors at every stage of the decision-making process.

Noticing (defining and interpreting) SWS behaviours

Nurses shared an accurate understanding of the terms 'insomnia' and 'respiratory distress' and were confident and succinct in their definitions. They found 'irritability' harder to define, but it was usually described as difficulty in consoling the child despite trying the usual comfort measures and parental presence. 'Hypertonicity' was the most problematic term with one nurse unable to offer a definition and another giving an inaccurate definition. Although the remaining nurses offered a definition of "increased tone", half of them expressed doubt or lacked confidence about their explanation.

When talking about the definitions, there was a tendency for nurses to blur the boundaries between signs, describing the co-existence or overlapping of some behaviours. Two nurses described the interdependence of insomnia and irritability. During a definition of 'irritability', one nurse explained *"it's linked a bit to the insomnia where you can see that*

they are tired and want to sleep."(N5) Another nurse's definition of 'irritability' appeared to overlap with 'insomnia'; *"you sort of think they are settled, they sort of shut their eyes and they go still and then two minutes later they're awake you know, they're off again"* (N10).

Inaccurate mapping of other behaviours to SWS signs was identified as another perceptual problem. Descriptions of motor disturbance were made by half of the nurses during their definitions of insomnia, irritability or hypertonicity. When defining 'insomnia' one nurse commented that *"They may be active, arms, legs, head, generally moving so they're not peacefully asleep"* (N10). A definition of 'irritability' included *"thrashing their arms and legs around or their head around"* (N9). 'Hypertonicity' was described as:

> *"Just constant moving of arms and legs, inability to stay still really, some of the babies they look like they're riding bikes lying in their cot because their legs just keep going round and their arms keep waving."* (N8)

'Insomnia' presented challenges for nurses in terms of both recognising and interpreting this behaviour. Lack of familiarity with the patient made it difficult to know if the patient's behaviour was different to normal, as one nurse described *"unless you know exactly what they're like without any of the illness, medication and what have you"* (N4). Trying to making sense of current behaviour by ascertaining recent trends was also complicated by the perceived subjective nature of the assessment *"if you look at the previous 12 hours, you've only got the chart to go from, so when somebody's marked down awake or asleep, you don't know if they've really been asleep for a whole hour or is it just 10 minutes"* (N7). However, confidence grew throughout the shift *"because you've done a whole day with them…."* (N10) and nursing a child on consecutive days was also viewed positively, because *"then you've*

got a better comparison as to whether they are more or less alert than they were the previous day" (N9). Environmental factors were also identified as possible causes of insomnia, as one ICU nurse described, *"ICU is noisy, it's loud, we forget and our colleagues talk and have to be shushed a lot of the time throughout the night, the monitors are always bleeping…"* (N5).

The main challenge with interpreting 'irritability' related to deciding whether this behaviour was a result of withdrawal or other co-morbidities. Nurses talked about undertaking a process of eliminating other possible causes of 'irritability' before attributing it to withdrawal. As one nurse described *"it's never the first thing I think when they're crying, they might be hungry or I'll check their nappy, and when I've covered all the bases then I'll be like actually they're irritable* (N12).

Lack of familiarity with the patient was raised again but some nurses described working with parents to interpret the child's behaviour, because *"they know them better than us"* (N2). In children with neurological impairment, nurses described relying on parents to identify whether behaviours differed from normal, as one nurse explained; "*I walk into the situation and I don't know the child I might think – 'oh my word this baby's really agitated'. But the parent's might go – 'well that's him when he's well'"* (N8). Nurses appeared to be most confident in recognising 'respiratory distress' but found the challenge was judging whether it was a sign of withdrawal or another co-morbidity. One nurse commented *"It's hard with the respiratory distress side of things, because if he's chronic lung disease, it's like Catch 22 isn't it?"* (N6**).**

DISCUSSION

This paper is the first to our knowledge describing the use of cognitive interviews and vignettes to examine the stages of decision-making undertaken by nurses in the assessment and management of withdrawal syndrome. Our study showed that nurses used a variety of approaches alone or in combination including intuition, reasoning, biases and heuristics, as reported by Tanner (2006). The use of SWS did not standardise nurses' assessment of withdrawal and cognitive challenges arose in each stage (noticing, interpreting and responding) of decision-making examined. These stages will be discussed in light of the overarching clinical goal of improving the assessment and management of withdrawal syndrome. As SWS shares a similar format and content to SOS and WAT-1, these findings suggest that cognitive challenges may also exist for nurses using SOS and WAT-1. As all nurses in the study made at least one cognitive error, there did not appear to be a relationship between quality of decision-making and either experience or their clinical specialism. Our results support the view that "simply possessing clinical experience is no predictor of high quality decision-making" (Thompson *et al*. 2009, p. 610).

The noticing stage - identifying and describing individual withdrawal behaviours - presented the greatest cognitive challenge for nurses and the widest variation in responses. When asked to describe withdrawal signs, nurses could plainly visualise a withdrawing child, demonstrating the "pattern recognition" of expert judgement and decision-making (Berner & Graber 2008, p. S12). Difficulty arose in separating the component behaviours to fit a list of withdrawal signs, leading to a blurring of boundaries between terms and inaccurate mapping of other signs. Although deconstruction of withdrawal syndrome into an item pool of component behaviours may be a necessary stage in scale development (DeVellis 2012),

within the experimental conditions of this study, this step appears to add complexity rather than simplifying the assessment.

Nurses recognised that they lacked knowledge needed to interpret some SWS items, as they were mostly not cognisant of the child's normal behaviour. Knowing the patient and their pattern of responses is considered fundamental to sound clinical judgement (Tanner 2006) promoting a corresponding sense of salience (Benner & Tanner 1987), whilst less knowledge impacts on the capacity to notice subtle cues or changes. Although no reflection on the nurses in this study, this deficit in personal knowledge of the child is a limitation in the application of SWS. Accurate withdrawal assessment relies not only on a shared meaning of clinical terms but also on a shared interpretation of these behaviours in each patient. Despite the close observation possible in critical care, recognising subtle behavioural changes is more challenging in an unfamiliar patient. Including parents routinely in the assessment may benefit the process in identifying a personalised baseline of behaviours upon which to consider new signs or identify trends, an approach endorsed in other complex clinical situations such as delirium (Schieveld *et al.* 2009) and pain assessment in children with severe neurological disability (Hunt *et al.* 2004).

Interpretation of the vignettes differed widely, despite every nurse being presented with the same information and clinical cues. This variation in decision-making in the face of identical information mirrors other studies involving nurses and pain assessment (Hodgins 2002), nurses and critical event risk assessment (Thompson *et al.* 2009) and triage assessments made by emergency nurses Cioffi (1998). These findings support the view that clinical judgements are influenced more by what nurses bring to the situation than by the clinical data available to them (Tanner 2006). The effort required to reach a diagnosis also

varied widely: nurses who made a definite diagnosis found the decision easier than those who were unsure. For some nurses in V1, the score alone gave a clear diagnosis of withdrawal, abnegating the cognitive burden of interpreting the meaning of ambiguous clinical signs. Indeed Benner & Tanner (1987) warned against the over-reliance on assessment tools, which could encourage a complacent "checklist mentality" rather than the rigour of "active enquiry".

The ability to see some aspects as more important than others has also been described as a sense of salience by Sitterding and colleagues (2012): this sense of salience was lacking amongst nurses who overlooked the fundamental importance of recent drug history as the context for a withdrawal assessment. In the face of such complexity, and the need to consciously consider the context of drug dependence, the role for the subconscious cognitive processing characteristic of intuitive thinking is unclear. Nurses who were unable to reach a diagnosis found the task harder, reflecting their recognition of the ambiguities, complexity and incompleteness of the available information, demonstrated superior decision-making (Brannon & Carson 2003). Some nurses made probability judgements (possibly, probably or maybe withdrawing), which also inferred a cognitive flexibility to modify their opinion in light of further information (Szolovits & Pauker 1978). Whether as a result of complacency, overconfidence or a checklist mentality, this study suggests that some nurses have a misplaced confidence in the diagnostic capacity of SWS, which would consequently limit further enquiry. The potential for cognitive errors during this interpretive phase highlights the importance of learning clinical reasoning skills, ideally during nurse training (Levett-Jones *et al.* 2010, 2015).

The responding stage was the most consistent phase of decision-making with treatment decisions corresponding to nurses' definite diagnoses. Cioffi (1999) describes the relationship between cues and inferences as decision rules or "if…then" rules. For example, "If a patient is withdrawing (cues) then the drug reductions should cease (inference)" or "If a patient is not withdrawing, then drug weaning should continue." However, when nurses were unsure of the diagnosis, an inclination towards 'doing something' meant the most common intervention was to stop weaning chloral hydrate. This tendency towards action rather than inaction, despite no supporting evidence for the decision, is commission bias (Croskerry 2003). Unnecessary slowing of weaning regimes should be avoided however, as prolonging sedative treatment may prolong recovery and hospitalisation. Administration of analgesics was another common treatment choice made by nurses, regardless of withdrawal diagnosis, perhaps reflecting an 'obligation towards beneficence' another example of commission bias (Croskerry 2003) - despite no supporting evidence of the need for analgesia.

LIMITATIONS

This study has a number of limitations. Whilst the cognitive interview technique is unique in revealing cognitive processes in participants, results are not generalizable to a wider population. The interviewer works as a nurse specialist in the hospital where the study took place and was known to the nurses participating in the interviews and they identified themselves as competent in using the SWS: these factors may have affected the nurses' responses.

The bedside treatment schedule of withdrawal in the study hospital includes a guidance to stop weaning with SWS scores between 3 and 6. The treatment schedule was not presented or discussed but it may be that some nurses recalled that a score of 5 linked to guidance to stop weaning. The number of withdrawal diagnoses in V1 may have been influenced by the fact that the participants were aware that the study was addressing sedation withdrawal; this might have created a diagnostic strategy of 'going for the obvious' that may not reflect typical decision-making.

CONCLUSION

This study using cognitive interviews with vignettes has provided insight into nurses' judgement and decision-making in a complex and ambiguous clinical situation. Focussing on the whole decision-making process (noticing, interpreting and responding) identified a significant cognitive burden and the potential for cognitive error at each stage. The use of a withdrawal assessment tool did not appear to simplify the process or reduce the burden.

There appears to be an inherent flaw in relying on a behavioural assessment using non-specific signs in a population where knowledge of usual behaviour is an essential prerequisite. Including parents in the assessment may expedite recognition of behavioural changes or trends. Key areas for improvement are in recognising the clinical context necessary for withdrawal and minimising the use of biases and failed heuristics. Revealing typical thought processes provides opportunity to reflect on complex cases, which may help to support critical thinking and reduce cognitive errors.

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Table 1 **Comparison of withdrawal tools**

Symptom	Agreement	SWS	SOS	WAT-1
Sweating	Symptom occurs in all 3 tools.	✓	✓	✓
Tremor		✓	✓	✓
Fever		✓	✓	✓
Diarrhoea		✓	✓	Loose, watery stool
Vomiting		✓	✓	and retching, gagging
Hypertonicity		✓	✓	✓
Insomnia	Symptom occurs in 2 of 3 tools.	✓	✓	
Irritability		✓	✓	
Respiratory distress		✓	Tachypnea	
High pitch cry		✓	Inconsolable crying	
Sneezing		✓		✓
Motor disturbance			✓	Uncoordinated, repetitive movement
Agitation	Symptom occurs in 1 tool only.		✓	
Hallucinations			✓	
Convulsion		✓		
Yawning				✓
Tachycardia			✓	
Grimacing			✓	
Startle to touch				✓
Time to regain calm state				✓
Anxiety			✓	

Table 2 **Decision-making key stages**

Model	Stage 1	Stage 2		Stage 3
Situation Awareness (Endsley, 1995)	Perception	Comprehension		Projection
Thinking like a nurse (Tanner, 2006)	Noticing	Interpreting		Responding
Bruner's phases of interpretation (Kuhlthau, CC., 1993)	Perception	Process of recognising patterns	Making inferences	Prediction
Cognitive Model of Response Processes (Tourangeau et al., 2000)	Comprehension	Retrieval	Judgment	Response

Table 3 **Application of the SWS tool**

Nurse	Ward	Experience	Vignette 1		Vignette 2		Intervention				
							Codeine	Stop weaning chloral	Increase chloral	No intervention	Other intervention
N1	PICU	5y	Yes	Easy	Yes	Not difficult	Maybe	Yes	Maybe		Distraction
N2	HDU	7y	Yes	Not easy	Don't know	Difficult	Yes	Yes			
N3	HDU	5y	No	4/10 easy	No	Easier than previous				No intervention	Investigate tremor
N4	HDU	10y	Probably	Quite easy	Don't know	Harder with more info		Yes			Paracetamol, speak to mum
N5	PICU	5y	Don't know Possible	Difficult (v)	Don't know	Very difficult				No intervention	Monitor
N6	Cardiac ward	13y	Yes	Easy	Yes	Quite easy	Yes	Yes	Maybe		
N7	PICU	10y	Don't know	Very difficult	Don't know Yes	Easier than previous	Yes	Yes			
N8	Cardiac ward	13y	Yes possible	Should be easy with more information	No	Quite easy	Maybe				Paracetamol, oral morphine, pain team, neurology
N9	Cardiac ward	13y	Can't comment		Maybe	Difficult	Yes	Yes	Maybe		Paracetamol, physio, neurology
N10	PICU	10y	Can't comment		No	Quite difficult	Maybe				Speak to parents
N11	HDU	13y	Yes	Quite hard	Don't know No	Not asked	Maybe	Maybe			Paracetamol
N12	Cardiac ward	4y	Don't know	DNA	Yes	Easier for this one	Yes	Yes	Maybe		Paracetamol

Table 4 **What nurses considered when deciding about withdrawal**

V1 (Insufficient information provided)

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N 10	N 11	N 12
Diagnosis	Y	Y	N	?	?	Y	?	?	C	C	Y	?
SWS Score	✓	✓		✓		✓		✓	✓			✓
Underlying condition/ pain/environment		✓	✓		✓	✓	✓	✓			✓	✓
Need info about SWS score trend (T)/ drug therapy (D)								D	TD			D
Made assumptions	✓	✓			✓					✓		

Diagnosis	Y	withdrawing	N	Not withdrawing	?	Unsure	C	Can't comment

V2 (Information provided about co-morbidities and potential for physical dependence)

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N 10	N 11	N 12
Diagnosis	Y	?	N	?	?	Y	?	N	?	N	?	Y
Underlying condition/ normal behaviour		✓	✓	✓	✓		✓	✓	✓	✓	✓	
Drug therapy		✓				✓	✓			✓		✓
Not physically dependent			✓	✓	✓			✓	✓	✓		✓
Made assumptions	✓						✓					

Table 5 **Cognitive errors identified during protocol analysis**

Cognitive error	Example	Nurse
Commission bias	Stopping chloral hydrate despite being unsure about withdrawal.	2,4,7,9
	Administering analgesia.	4,8,9,12
Confirmation bias	Diagnosing withdrawal despite recognising the duration of sedation was too short.	12
Overconfidence bias	Acting on incomplete information or intuitions. Any definitive diagnosis in V1.	1,2,3,6,11
	Making assumptions.	1,2,5,7,11
Availability heuristic	Accepting a diagnosis that springs easily to mind. Relying on the SWS score alone to make a diagnosis without considering the wider context.	1
Anchoring heuristic	Choosing to stick with one's original diagnosis despite more information becoming available.	1,3,6

Figure 1 **Vignettes and Intervention(s)**

Vignette 1

18 month old boy admitted to ICU 18 days ago in respiratory failure (Lower respiratory tract infection secondary to tracheomalacia).

SWS score is 5 (insomnia 1, irritability 1, tremor 1, respiratory distress 1 and hypertonicity 1)

Vignette 2

History of presenting condition 18 month old boy admitted to ICU 18 days ago in respiratory failure (Lower respiratory tract infection secondary to tracheomalacia).

Past Medical History severe hypoxic ischaemic encephalopathy, chronic lung disease, epilepsy.

Past Surgical History Aortopexy 6 days ago.

He was extubated 4 days previously but within 24 hours required insertion of NPA and CPAP. NPA removed 24 hours ago.

Sedation fentanyl and midazolam infusions for 48 hours post op stopped 4 days ago. Regular chloral hydrate and codeine started 3 days ago. Chloral hydrate weaning started yesterday and codeine stopped.

His SWS score is 5 (insomnia 1, irritability 1, tremor 1, respiratory distress 1 and hypertonicity 1)

Intervention(s)

What intervention would you recommend? You can provide one or more answers.

Give codeine*

Stop weaning chloral hydrate

Increase dose of chloral hydrate

Restart fentanyl

Restart midazolam

No intervention

Other intervention – please state

*Codeine was included in the list of interventions as this study took place prior to restrictions in the use of codeine in children under 18 years of age, issued by the Medicines & Healthcare products Regulatory Agency (MHRA, 2013).

Figure 2 **Withdrawal diagnosis and Interventions chosen**